

A PRELIMINARY REVISION OF THE INDO-PACIFIC SPECIES OF OPHIOGLOSSUM (OPHIOGLOSSACEAE)

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INTRODUCTION

The differences between the most recent complete treatment of this genus by Clausen (1938) and the present revision are, I think, of a rather fundamental nature. For, though Dr Clausen and myself agree that in the troublesome taxa, 'the small number of characters . . . has forced workers . . . to base conclusions concerning species often on trivial details such as leaf cutting and size, characters which would not ordinarily be considered of fundamental importance in other groups' (*l.c.* p. 5), from there on we have followed a different train of thought. Clausen stated (*l.c.* p. 6) that 'If these characters were not adopted as criteria for species, it would be necessary to reduce the species to a very small number and thereby remove the opportunity to keep apart populations which appear to be really distinct enough, but for which the characters available for species differentiation do not seem fundamental.'

This comes very close to Prantl's critics (1884, 300) on Luerssen's treatise where he stated: ". . . so scheint die Frage, ob sie (*i.e.* the forms which Luerssen brought together under *O. vulgatum*) als Varietäten oder als ebensoviele Arten zu bezeichnen sein, von untergeordneter Bedeutung zu sein. . . . Es gibt eine grosse Anzahl von Sammlern, Floristen *etc.*, deren wissenschaftliches Bedürfnis befriedigt ist, wenn sie auf Etiquetten oder in Katalogen einen aus zwei Worten bestehenden Namen schreiben können; auf 'Varietäten' wird eine Rücksicht in der Regel nicht genommen." In order to facilitate geographical studies based on these determinations Prantl then chose to accept a small species concept.

My point of view is, however, that in general one should be very careful in basing specific delimitation primarily on characters, which are known to be of no or only secondary importance in most other vascular plants. In the case of *Ophioglossum* where these characters hardly show sharp demarcation and are so little correlated with other characters, I do not think we should use them. Apart from this the cytogenetical studies of Prof. Manton and her coworkers have shown that in complex taxa, as some species of *Ophioglossum* may well be, the degree of the relationships often cannot be predicted on morphological evidence alone. The taxa in the *Dryopteris spinulosa* complex for instance have been shown to be probably good species with highly sterile hybrids (Manton, 1950, 70—71; S. Walker, 1955, 198—208), while the relationship between *Pteris quadriaurita sensu stricto* and *P. multiaurita* has been shown to be that of two extremes of a fully fertile continuous series (T. G. Walker, 1960, 321—332). A crossing and breeding program in *Ophioglossum* has, as far as I know, not yet been started, and such a program certainly would be a very time-consuming one, *Ophioglossum* being a strictly mycorrhizal genus with presumably rather slowly growing gametophytes. For this reason we are forced to use for the time being morphological evidence only. This leads us, I think, to

recognize only a few species with some varieties or forms. Moreover, the chromosome numbers in *Ophioglossum* are very high ($n = c. 120-630$), suggesting high rates of polyploidy which may well have resulted in genotypical differences and thus genetic variation of more than usual importance within the same species.

A search for the type specimens of the many taxa described in literature would have been unduly time-consuming, especially as the original descriptions are often not accompanied by a direct indication of the type specimen. Where this could be done easily, the type specimens have been examined; in all other cases the original description, and eventual figure, have been consulted.

Because of the restricted aim of this paper, which is largely intended as a revision of the Malaysian species, I have cited under the species and their synonyms only references to the most important literature. This restriction was also urgent because of the many misinterpretations of the species and misidentifications of specimens which cannot all be cited. Descriptions and ecology have largely been based on Malaysian collections.

Anatomical characters, except those of the leaf margin, have been omitted; for them I refer to Nishida (1952, 165-171).

All chromosome numbers cited in the descriptions are taken from Ninan (1958).

I wish to express my sincere thanks to all who helped me in various ways to finish this work, to Prof. Lam who encouraged me to undertake this study, to Dr Holtum and Dr Donk for advice, to Dr Leenhouts for criticism, to Miss van Crevel for making the drawings, to Mr van Brummelen for help with the photographs, and to Prof. van Steenis for supervising the MS.

Many thanks are also due to the directors and curators of the following Herbaria, who kindly put their material at my disposal: Bogor, the British Museum (Nat. Hist.) Botany Department, Calcutta, Copenhagen, Kew, Leyden, Manilla, Melbourne, Paris, Singapore, and Zürich.

OPHIOGLOSSUM

Tourn. *ex* Linn., Gen. Pl. ed. 5 (1754) 484; Sp. Pl. (1753) 1062. — *Ophioglossum* sect. *Ophioderma* Bl., En. Pl. Jav. 2 (1828) 259. — *Ophioderma* Endl., Gen. Pl. 1 (1836) 66.

Trophophyll, if present, simple or furcate; venation closed, reticulate; fertile stalk simple (rarely furcate); sporangia placed in two lateral rows, partly immersed in the axis, opening transversely.

KEY TO THE SUBGENERA AND SPECIES

1. Strobilus with a sterile apex; demarcation between trophophyll and common stalk clear-cut; trophophyll not or only at the base adnate to the fertile stalk; venation mostly with at least a few secondary veinlets. Fig. 1 a-c, 2 b. Subgenus OPHIOGLOSSUM
2. Trophophyll with a conspicuous, pale, median band; venation double; rhizome globose, bearing very many fibrous roots; marginal cells of the trophophyll distinctly longer than wide, with the outer wall quite straight, margin of the trophophyll very smooth (microscope!). Fig. 1 d; photogr. 1
 1. *O. costatum*
2. Trophophyll without a pale, median band; venation not double, though free ending veinlets and some areolets may be present; rhizome cylindrical or subglobose, bearing a few to rather many, mostly fleshy roots; marginal cells and/or margin of the trophophyll not so.
 3. Trophophyll linear or lanceolate, more than 6 times as long as wide, apex nearly always acute; venation, especially in the lower part of the trophophyll, with mostly very long-stretched areoles; marginal cells of the trophophyll very long-stretched, with the outer wall mostly slightly curved. Fig. 2 b; photogr. 2, 3. 2. *O. gramineum*

- 3. Trophophyll never linear, less than 6 times as long as wide, apex often obtuse, sometimes acute; venation never with very long-stretched areoles in the lower part of the trophophyll; marginal cells not so.
- 4. Marginal cells of the trophophyll mostly more or less isodiametric, with the outer wall quite straight, margin of the trophophyll quite smooth (trophophyll in a few cases absent); mostly small plants of 2—12 (—20) cm high. Fig. 1c; photogr. 4. 3. *O. nudicaule*
- 4. Marginal cells of the trophophyll rather variable in shape, often more wide than long, with the outer wall often clearly curved, margin of the trophophyll not so smooth, but not always as irregular as in photogr. 5—7; plants mostly higher. Fig. 1 a—c; photogr. 5—7.
- 4. *O. reticulatum*
- 1. Strobilus with a fertile apex; trophophyll, if present, gradually attenuate into the common stalk (stalk often hardly discernable); trophophyll mostly conspicuously adnate to the fertile stalk; venation consisting of primary veins only. Fig. 2 a, c. Subgenus OPHIODERMA
- 5. Trophophyll absent or vestigial; sometimes a small, completely sterile frond present; plant terrestrial.
 - 5. *O. simplex*
- 5. Trophophyll present; plant epiphytic or terrestrial.
 - 6. Plant terrestrial, trophophyll never falcate. Fig. 2 c. 6. *O. intermedium*
 - 6. Plant epiphytic, if terrestrial then trophophyll falcate 7. *O. pendulum*

Subgenus OPHIOGLOSSUM

Ophioglossum subg. *Euophioglossum* (Prantl) Clausen, Mem. Torrey Bot. Cl. 19 (1938) 120; Nishida, J. Jap. Bot. 27 (1952) 166, 167. — Sect. *Verae* Bl., En. Pl. Jav. 2 (1828) 259. — *Ophioglossum sensu* Endl., Gen. Pl. 1 (1836) 66; Presl. Suppl. Tent. Pterid. (1845) 48 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 308]; Nakai, Bot. Mag. Tokyo 39 (1925) 193; *op. cit.* 40 (1926) 373; Nishida, J. Jap. Bot. 27 (1952) 275; Bull. Nat. Sc. Mus. Tokyo 4 (1959) 327. — Sect. *Euophioglossum* Prantl, Ber. Deut. Bot. Ges. 1 (1883) 350; Jahrb. K. Bot. Gart. Berl. 3 (1884) 299.

Terrestrial species; clear-cut demarcation between common stalk and trophophyll; trophophyll not or only basally adnate to the fertile stalk; venation mostly with at least a few secondary veinlets; walls of epidermis cells of the lamina often curved; fertile part when mature always longer than the trophophyll; strobilus always shorter than its stalk and with a sterile apex; mature spores roundish, with a reticulate or punctate exospore wall (fig. 1 a—e, 2 b).

1. *Ophioglossum costatum* R. Br., Prodr. Fl. Nov. Holl. 1 (1810) 10; Pichi-Sermolli, Webbia 9 (1954) 628. — *O. pedunculatum* Desv., Mag. Ges. Naturf. Fr. Berl. 5 (1811) 306. — *O. fibrosum* Schum., Kong. Danske Vidensk. Selsk. Natur. Math. Afh. 4 (1829) 226. — *O. wightii* Grev. & Hook., Bot. Misc. 3, part 8 (1832) 218. — *O. vulgatum* var. *costatum* (R. Br.) Hook. f., Fl. Tasm. 2 (1860) 153, t., 169. — *O. brevipes* Bedd., Ferns S. India (1863) 23, t. 72. — *O. bulbosum* Bedd., Ferns Brit. India Suppl. (1876) 28. — *O. aphrodisiacum* Welw. ex Prantl, Ber. Deut. Bot. Ges. 1 (1883) 352. — **Fig. 1 d; photogr. 1.**

Plant (2—)10—25 cm high; rhizome globose, bearing very many fibrous roots and mostly several fronds simultaneously, often one or two of which without fertile part; common stalk (0.1—)1.5—5 cm long; trophophyll 2.5—9 by 1—2.5 cm, sessile or subsessile, with a conspicuous, pale, median band, mostly elliptic, sometimes ovate or obovate, base mostly cuneate, sometimes truncate, apex mostly acute or apiculate, sometimes obtuse; venation, except for the long-stretched areoles in the median part (pale band), double, *i.e.* the secondary veinlets forming secondary areoles within the primary areoles; marginal cells of the trophophyll distinctly longer than wide, with the outer wall quite straight, margin of the trophophyll quite smooth (microscope!); fertile

part mostly much longer than the trophophyll; fertile stalk (1—)5—18 cm long; strobilus (0.2—)1—6 cm long, much shorter than the stalk, mostly no sharp demarcation between strobilus and stalk; $n = 120$.

Distribution. According to Pichi-Sermolli, *l.c.*: Ascension I., Tropical and South Africa, Comores Arch., Madagascar, India, Ceylon, and Sumatra to East Australia and? New Zealand; specimens examined from India, Ceylon, Thailand, the Malay Peninsula, and the Philippines.

2. *Ophioglossum gramineum* Willd., Nov. Act. Acad. Erf. 2 (1802) 18, t. 1, f. 1. — *O. vulgatum* L. var. *gramineum* (Willd.) Hook. f., Fl. Nov. Zel. 2 (1854) 50. — *O. dietrichiae* Prantl, Ber. Deut. Bot. Ges. 1 (1883) 352. — *O. moluccanum* Schlechtend. f. *inconspicuum* Rac., Nat. Tijd. Ned. Ind. 59 (1900) 237, t. 2, f. 5. — *O. inconspicuum* (Rac.) v. A. v. R., Bull. Dép. Agr. Ind. Néerl. 21 (1908) 9, *incl. var. majus* v. A. v. R., *l.c.* — *O. gregarium* Christ, Nova Guinea, Bot. 8 (1909) 164. — **Fig. 2b; photogr. 2, 3.**

Plant 4—25 cm high; rhizome bearing 1—10 fronds simultaneously, sometimes one or more of them lacking the fertile part; common stalk 1.5—8 cm long; trophophyll 1.5—7.5 by 0.1—1 cm, sessile, rarely attenuate into a petiole, linear or lanceolate, more than 6 times as long as wide, apex acute, very rarely bluntish and apiculate; venation, especially in the lower part, with mostly very long-stretched areoles and without or with only a few free ending veinlets; marginal cells of the trophophyll very long-stretched, with the outer wall mostly slightly curved, margin of the trophophyll not absolutely smooth (microscope!); fertile stalk 4—11 cm long; strobilus 0.5—7.5 cm long; $n = c. 120$.

Distribution. The species is probably pantropical, though nowhere common.

Ecology. Mostly moist places along riverbanks, among rocks, *etc.*; often on sandy soil.

2a. var. *gramineum*.

Plant 4—10 cm high; rhizome bearing 1—3 fronds simultaneously; common stalk 1—6 cm long; trophophyll 1.5—2 cm long; strobilus 0.5—2 cm long, often sharply set off against the stalk.

Distribution. Specimens examined from Vietnam, East Borneo, East Java, Moluccas (Tanimbar), and New Guinea.

2b. var. *majus* (v. A. v. R.) Wief., *comb. nov.* — *O. inconspicuum* (Rac.) v. A. v. R. var. *majus* v. A. v. R., Bull. Dép. Agr. Ind. Néerl. 21 (1908) 9. — *O. gregarium* Christ, Nova Guinea, Bot. 8 (1909) 164. — **Fig. 2b; photogr. 3.**

Plant 9—25 cm high; rhizome bearing 2—10 fronds simultaneously; common stalk 3.5—8 cm long; trophophyll up to 7.5 cm long; strobilus up to 7.5 cm long, mostly gradually passing into the stalk.

Distribution. Specimens examined from the Philippines (Luzon) and New Guinea.

Note. The shape of the fronds and of the strobili of Micholitz's specimens from Tanimbar show a slight approach to *O. reticulatum*.

3. *Ophioglossum nudicaule* L. f., Suppl. Syst. Pl. (1781) 443; Desv., Mém. Soc. Linn. Paris 6 (1827) 194 (*'medicaule'*); Presl, Suppl. Tent. Pterid. (1845) 54 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 314]; Clausen, Mem. Torrey Bot. Cl. 19 (1938) 143, 146, 147, 150, 151, *incl. var. tenerum* (Mett.) Clausen *et var. macrorrhizum* (Kze) Clausen, *excl. var. grandifolium* Clausen. — *O. capense* Schlechtend. var. *nudicaule* (L. f.) Schlechtend., Adumbr. Fil. Prom. Bonae Spei (1825) 9. — *O. vulgatum* var. *macrorrhizum* (Kze) Luerssen,



Fig. 1. a. *Ophioglossum reticulatum* f. *complicatum*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Furtado SFN 35546. — b. *O. reticulatum* f. *reticulatum*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Brass 24108. — c. *O. reticulatum* f. *dilatatum*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Hose 173. — d. *O. costatum*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Beddome s.n. — e. *O. nudicaule* var. *macrorrhizum*, $\times \frac{1}{2}$, venation $\times 6$, Schram BW 12257.

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J. Mus. Godeffr. 3 (1875) 242, 244, many fig. — *O. luersseni* Prantl, Ber. Deut. Bot. Ges. 1 (1883) 352; Jahrb. K. Bot. Gart. Berl. 3 (1884) 304, 308, 310, 321, 345, 348, t. 8, f. 20. — *O. moluccanum* Schlechtend. f. *pumilum* Rac., Nat. Tijds. Ned. Ind. 59 (1900) 237, t. 2, f. 2, 3. — *O. pumilum* v. A. v. R., Mal. Ferns (1908) 774; Bull. Jard. Bot. Btzg sér. II, 7 (1912) 22, 23; Mal. Ferns Suppl. 1 (1917) 453, 454. — *O. schlechteri* Brause, Bot. Jahrb. 49 (1912) 58, 59, f. 3E. — *O. lineare* Schlechter & Brause, Bot. Jahrb. 49 (1912) 59, f. 3F. — **Fig. 1 e; photogr. 4.**

Plant 2—12(—20) cm high, rhizome mostly subglobose, sometimes cylindrical; common stalk 0.2—4 cm long; trophophyll 0.4—3.5 by 0.3—2 cm, often attached at the lower quarter of the frond, sessile or shortly stalked, rarely absent, ovate or roundish, rarely obovate or lanceolate, base often somewhat cordate or truncate, more rarely attenuate, apex acute or obtuse, mostly slightly apiculate, texture mostly rather fleshy; venation rather lax to rather dense, with rather few to rather many free ending veinlets; marginal cells of the trophophyll mostly more or less isodiametric, with the outer wall quite straight, margin of the trophophyll quite smooth (microscope!); fertile stalk 1—8 cm long; strobilus 0.2—2.5(—3) cm long, mostly rather abruptly set off against its stalk and the lowest sporangia mostly reaching maturity.

Distribution. Pantropic. Specimens examined from Ceylon, India, Burma, Yunnan, Thailand, the Malay Peninsula, Sumatra, Krakatao I., Java, Borneo, Philippines (Luzon), Moluccas (Ternate, Halmahera), the Marianas (Guam), Admiralty Is, New Guinea, Bismarcks (New Ireland), Louisiades (Fergusson I.), New Caledonia, and Hawaii.

Ecology. Open vegetations on impermeable soil, often along paths and trails, on stony ground, recently burned grasslands, etc.

3a. var. macrorrhizum (Kze) Clausen, Mem. Torrey Bot. Cl. 19 (1938) 150. — **Fig. 1e.**

Plant 2—7.5 cm high, often very slender, rhizome nearly always subglobose, trophophyll in dried material rather leathery, inserted near the base of the frond, 0.2—1.3 by 0.2—1.1 cm, at most shortly apiculate, strobilus 0.2—1.7 cm long.

Distribution. Specimens examined from China (Szechuan), Thailand, the Malay Peninsula, Sumatra, Java, Lesser Sunda Is (Lombok), Philippines (Luzon), New Guinea, and New Caledonia.

Notes. As is the with case *O. reticulatum* (see there), *O. nudicaule* as conceived in this paper is a polymorphic species. For practical reasons only the most pronounced and the only fairly clearly delimited form has been separated as a variety. All other specimens have been referred to the species.

The figures of Christensen (1932) do in my opinion not well agree with the type specimen of *O. nudicaule* L. f. (from the Cape of Good Hope) as was put forward by this author. The type specimen which is kept in the Linnean Herbarium and of which I have seen a photograph, has a quite different rootstock and ovate, longly petioled trophophylls. Christensen's figure shows much more slender specimens with a sub-globose rootstock and sessile, much shorter trophophylls. The latter seem to belong to var. *macrorrhizum*. As I do not know the African material well enough, I have refrained from designating Malaysian specimens to the type variety.

In some specimens of *O. nudicaule* the trophophyll is absent. These specimens were formerly designated as a different species, *O. lineare* Schlechter & Brause. Since, however, these plants may occur together with poorly developed specimens of *O. nudicaule* (Molesworth-Allen 2344) and since I am not able to find any other difference, I think they too are simply depauperated specimens of *O. nudicaule*.

4. *Ophioglossum reticulatum* Linn., Sp. Pl. (1753) 1063, *incl. var. pacificum* Christensen, Bull. Bish. Mus. 177 (1943) 7, t. 1, f. A. — *O. ovatum* Bory de Saint-Vincent, Voy. Quatre Princ. Iles Afr. 2 (1804) 206, 207. — *O. petiolatum* Hook., Exot. Fl. 1 (1823) t. 56; Hook. & Grev., Bot. Misc. 3, part 8 (1832) 217; Presl, Suppl. Tent. Pterid. (1845) 50 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 310]; Clausen, Mem. Torrey Bot. Cl. 19 (1938) 134–137. — *O. moluccanum* Schlechtend., Adumbr. Fil. Prom. Bonae Spei (1825) 9; Hook. & Grev., Bot. Misc. 3, part 8 (1832) 216; Presl, Suppl. Tent. Pterid. (1845) 53 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 313]; *incl. f. angustatum* Miq., *f. complicatum* Miq., *f. dilatatum* Miq., *f. maior* Miq. et *f. subcordatum* Miq., Ann. Mus. Bot. Lugd. Bat. 4 (1868) 92; *incl. f. lanceolatum* Rac., Nat. Tijds. Ned. Ind. 59 (1900) 237, t. 2, f. 4; *excl. f. pumilum* Rac., l.c. f. 2, 3. — *O. parvifolium* Hook. & Grev., Bot. Misc. 3, part 8 (1832) 218; Presl, Suppl. Tent. Pterid. (1845) 51 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 311]; Prantl, Jahrb. K. Bot. Gart. Berl. 3 (1884) 334, 348. — *O. elongatum* R. Cunn. ex A. Cunn. in Hooker, Comp. Bot. Mag. 2 (1836) 361; Presl, Suppl. Tent. Pterid. (1845) 49 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 309]. — *O. cordifolium* Roxb. [Hort. Bengal. (1814) 75, *nomen*; Wall., Cat. (1828) 47, *nomen*] ex Griff., Calc. J. Nat. Hist. 4 (1844) 475. — *O. cumingianum* Presl, Suppl. Tent. Pterid. (1845) 52, 53 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 312, 313]. — *O. cognatum* Presl, l.c. 53 [= l.c. 313]. — *O. schmidii* Kze, Linnæa 24 (1851) 246. — *O. vulgatum* (*non* L.) Miq., Ann. Mus. Bot. Lugd. Bat. 3 (1867) 183, *pro parte*; Profl. Fl. Jap. (1867) 347, 390; Hook. & Baker, Syn. Fil. (1868) 445, 446; Luerssen, J. Mus. Godeffr. 3 (1875) 241, 244, 246–248, t. 12, f. 18; *pro var. reticulatum* (L.) Luerssen, Mitt. Gesammtgeb. Bot. 1 (Fil. Graeff.) (1871) 446; J. Mus. Godeffr. 3 (1875) t. 15, f. 115–118, t. 16, f. 128–130; *pro var. australasiaticum* Luerssen, J. Mus. Godeffr. 3 (1875) 246, t. 13, f. 66–76, t. 15, f. 107, 108, t. 16, f. 125–127. — *O. obovatum* Miq., Ann. Mus. Bot. Bat. 4 (1869) 93; v. A. v. R., Mal. Ferns (1908) 775. — *O. timorensis* Miq., Ann. Mus. Bot. Lugd. Bat. 4 (1869) 93; v. A. v. R., Mal. Ferns (1908) 775. — *O. pedunculatum* (*non* Desv.) Prantl, Ber. Deut. Bot. Ges. 1 (1883) 353; Jahrb. K. Bot. Gart. Berl. 3 (1884) 305, 308, 310, 328–330, 333, 348, t. 8, f. 33, 34 et *auct. plur.*; Nakai, Bot. Mag. Tokyo 39 (1925) 193 (*pedunculatum*); *op. cit.* 40 (1926) 373, 374. — *O. raciborskii* v. A. v. R., Bull. Jard. Bot. Btzg. sér. II, 28 (1918) 35. — *O. nudicaule* var. *grandifolium* Clausen, Mem. Torrey Bot. Cl. 19 (1938) 151. — *O. austroasiaticum* Nishida, Bull. Nat. Sc. Mus. Tokyo 4 (1959) 329, t. 50, A–C.

Rhizome cylindrical or subglobose, sometimes stoloniferous, bearing mostly several fronds simultaneously; common stalk 1–15 cm long; trophophyll 1–8 by 0.5–5 cm, stalked or sessile, ovate, lanceolate, reniform, deltoid, or orbicular, rarely obovate or trullate, base attenuate, cuneate, obtuse, truncate, or cordate, apex acute or obtuse, often apiculate or acuminate; texture in dried specimens thin or rather coriaceous, in living specimens mostly rather fleshy; venation very lax with hardly any free ending veinlets, to rather dense and with many free ending veinlets, without or with a few areolets; marginal cells of the trophophyll rather variable in shape, often wider than long, the outer wall often clearly curved, margin of the trophophyll not smooth (though by no means always as irregular as in photographs 5–7); fertile stalk 1–20 cm long; strobilus 1–8 cm long; n different for different varieties and localities, ranging from 120–c. 630.

Distribution. Pantropic. Specimens examined (not referred to any of the forms) from Ceylon, India, Assam, Thailand, China (Hupeh), Korea (Quelpaert), Japan, Ryu Kyu Is, the Malay Peninsula, Sumatra, Borneo, Java (also Madura), Lesser Sunda Is (Bali, Timor), Celebes, Philippines (Luzon, Negros, Mindanao), Moluccas (Ambon, Ceram), New Guinea, Admiralty Is, Louisiades (Fergusson I.), New Caledonia, Samoa (Savaii), Society Is (Tahiti).

Ecology. This species may be found in a variety of humid, mostly shady, sites. It frequently appears on bare soil and is apparently often, at least epigaeic, only present during the wet monsoon.

Notes. *O. reticulatum* as conceived here is a highly polymorphous species. Many of its forms have at some time or other been considered as species or varieties.

Though I am aware that the forms recognized in this paper could be further subdivided, I have, for practical reasons refrained from doing so, as even they themselves are connected by many intermediates.

The orthographical error is not first made by Nakai in writing *pedunculatum* instead of *pedunculosum*, as is commonly supposed, but by Poiret (1816). Poiret, however, did not confuse this species with *O. reticulatum*.

I have seen *Thwaites CP 1408* from the herbaria of BO, CAL and L. The Calcutta specimens differ from the other ones in the trophophylls and the roots. For this reason I doubt the homogeneity of this number.

Zollinger 1777, which I studied from the collections of K, L, MEL, and Z, is a very heterogeneous number, most specimens of which I do not wish to place in anyone of the forms here recognized. All specimens on the Z sheet and one frond on the L sheet, however, are doubtless *f. dilatatum*.

Ramos & Deroz BS 22550 from the Philippines is noteworthy in that it has the lax venation, thin texture, and slender strobilus gradually passing into the stalk as is typical for *O. reticulatum f. dilatatum*, combined with the low attachment of the trophophyll and the more subglobose rhizome of *O. nudicaule*. The marginal cells of the trophophyll are like those of *O. reticulatum*. Clausen (1938, 151, 152) mentioned this form as *O. nudicaule var. grandifolium*.

Clemens 12444 from Papua has the lax venation of *O. reticulatum f. dilatatum* combined with the small size, the subglobose rhizome, and the sharp demarcation between stalk and strobilus of *O. nudicaule*. The attachment of the trophophyll varies in the several specimens of this number.

Von Römer 667 from New Guinea appears to be intermediate between *O. reticulatum* and *O. gramineum*. The shape of the frond and of the strobilus as well as the outer wall of the marginal cells of the trophophyll do not fit well with either species.

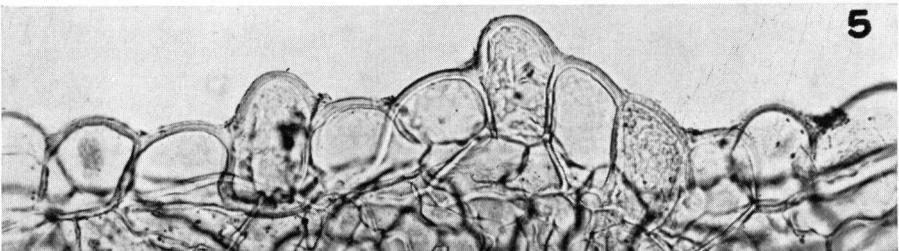
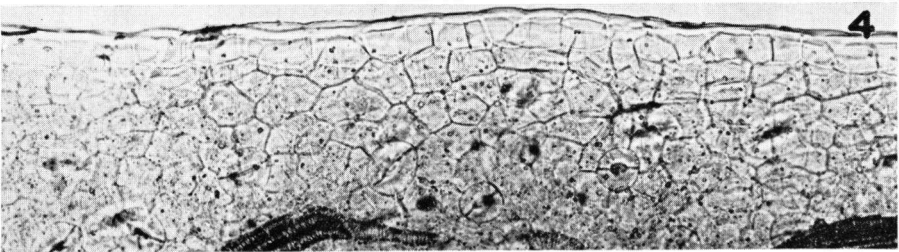
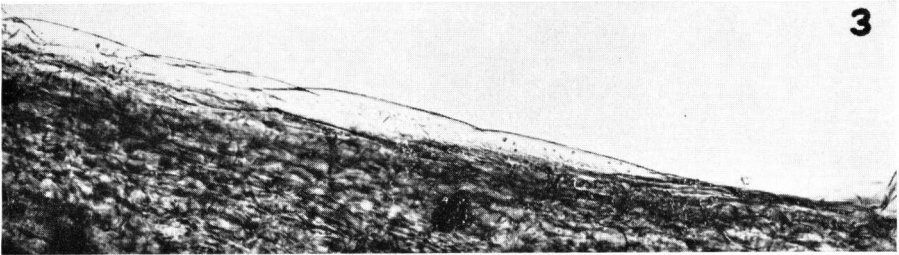
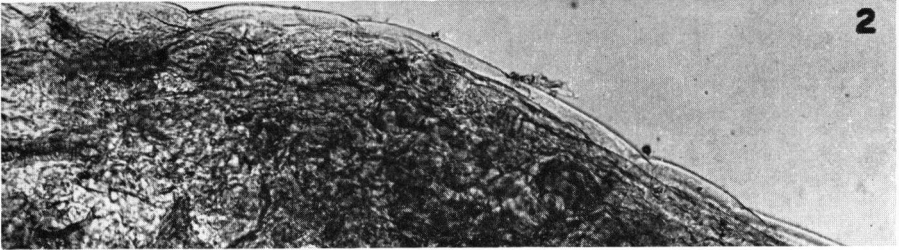
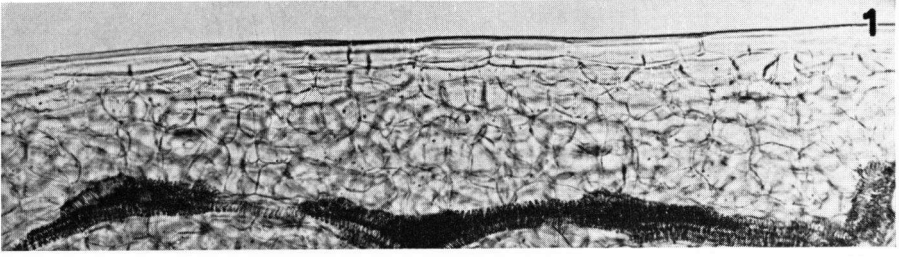
KEY TO THE FORMS

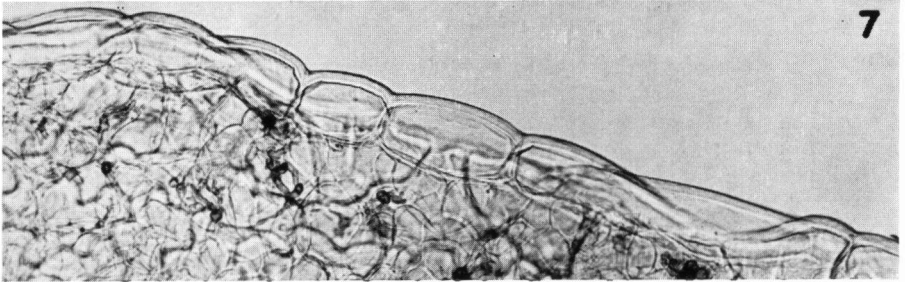
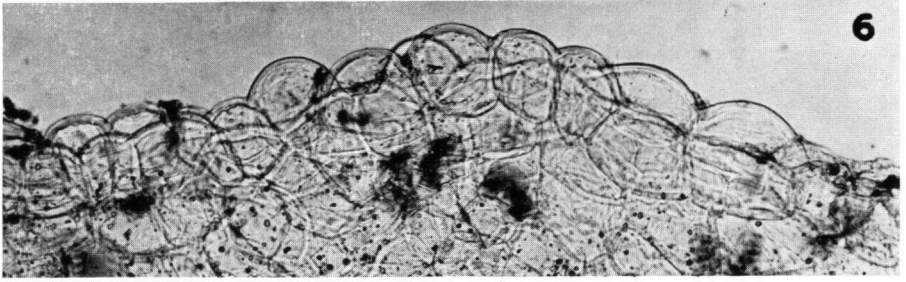
1. Trophophyll in dried material thin, venation rather lax.
 2. Trophophyll ovate, reniform, or orbicular, apex acute or obtuse, often apiculate, base often clearly cordate, mostly rather many free ending veinlets. a. *f. reticulatum*
 2. Trophophyll ovate, lanceolate, or trullate, apex never obtuse, often acuminate, never apiculate, base at most slightly cordate, at most a few free ending veinlets. b. *f. dilatatum*
1. Trophophyll in dried material rather coriaceous, venation rather dense. c. *f. complicatum*

4a. *f. reticulatum*. — Fig. 1 b; fotogr. 5.

Plant 8—30 cm high; rhizome cylindrical or subglobose; common stalk 0.5—10 cm long; trophophyll 1—6 by 0.5—5 cm, sessile or stalked, ovate, reniform, or orbicular, apex acute or obtuse, often apiculate, base cordate, truncate, obtuse, or rarely attenuate; texture in dried specimens rather thin; venation lax to rather dense, without or with very

Photographs of the leaf margin, *c.* × 140. 1. *Ophioglossum costatum*, Smitinand 4632. — 2. *O. gramineum* var. *gramineum*, Kostermans 4030a. — 3. *O. gramineum* var. *majus*, Docters van Leeuwen 9251. — 4. *O. nudicaule* Rahmat si Boeca 9925. — 5. *O. reticulatum f. reticulatum*, im Thurn 119.





few areolets, few to rather many free ending veinlets; fertile stalk 3—17 cm long; strobilus 1—5 cm long, mostly gradually passing into its stalk, basal sporangia often not reaching maturity.

Distribution. Typical specimens examined from India, Thailand, Indochina, Sumatra (also Krakatao I.), West Java, Lesser Sunda Is (Sumbawa), Borneo, Philippines (Luzon and Corregidor), Moluccas (Buru, Ambon, Ceram), Admityalty Is, Loyalty Is, Fiji Is (Viti Levu), Mangareva Is.

4b. f. dilatatum (Miq.) Wief., *comb. nov.* — *O. moluccanum* Schlechtend., Adumbr. Fil. Prom. Bonae Spei (1825) 9, *pro specimina, excl. typ.* — *O. moluccanum* f. *dilatatum* Miq., Ann. Mus. Bot. Lugd. Bat. 4 (1868) 92. — *O. vulgatum* var. *moluccanum* Luerssen, J. Mus. Godeffr. 3 (1875) t. 13, f. 78, *excl. typ.* — **Fig. 1 c; photogr. 6.**

Plant 6—35 cm high, rhizome subglobose, sometimes with stolons; common stalk 0.2—12 cm long; trophophyll 1—8 by 0.5—5 cm, attached at the lower half of the frond, sessile or stalked, ovate, trullate, or lanceolate, base truncate, cuneate, or slightly cordate, apex acute, often acuminate; texture rather thin; venation lax, with rather few big areoles and rather few free ending veinlets; fertile stalk 1—15 cm long, strobilus 1—6 cm long, gradually passing into the stalk, basal sporangia often not reaching maturity.

Distribution. Specimens examined from Sumatra (also Krakatao I.), the Malay Peninsula, Java, Lesser Sunda Is (Flores), Borneo, Philippines (Mindoro, Mindanao), and Fiji Is (Viti Levu).

Notes. Luerssen (1875, t. 13, f. 78) gave a picture of this form under the name *O. vulgatum* L. var. *moluccanum* (Schlechtend.) Luerssen. He based this name on *O. moluccanum* Schlechtend., which in its turn was based on the description and plate of *O. simplex* Rumphius (1750, 152, t. 58, f. 2). I am not convinced that the plant drawn by Rumphius belongs to this taxon.

The sheet of *Steenstra-Toussaint* 53 from Java in the Leyden Herbarium is not homogeneous, containing in the upper half a specimen of f. *dilatatum*, in the lower half a specimen of f. *complicatum*.

Van Steenis 11160 from West Java contains specimens of f. *dilatatum* as well as of f. *complicatum*. On the sheet the collector has written that the two forms were found next to each other without intermediates.

The collection number *Lörzing* 650 from Central Java contains specimens of *O. reticulatum* f. *dilatatum* and of *O. nudicaule*. On the accompanying label, Lörzing, who was well aware of the differences between these specimens, has written that they were not collected in the same location. The specimens belonging to the different taxa are not mounted on the same sheet.

In the collection of the British Museum the collection numbers *Clemens* 26158 and 27415 are mounted on the same sheet. As the material in BM of *Clemens* 26158 (f. *dilatatum*) does not match the material of the same number from BO, K, and L (f. *complicatum*), I think the labels on the BM sheet may have been interchanged. I must admit, however, that this solution does not solve the problem of the identity of *Clemens* 27415 and 29280. For if my suggestion is right, the BM material of *Clemens* 27415 as well as 29280 is both f. *dilatatum*, whilst the material in BO and K is f. *complicatum*.

On the sheets of *Clemens* 27415 (f. *complicatum*) from the collections of BO and K,

6. *O. reticulatum* f. *dilatatum*, *Bakhuizen van den Brink* 6306. — 7. *O. reticulatum* f. *complicatum*, *Franc* 476. — 8. *O. gramineum* var. *majus*, probably *Docters van Leeuwen* 9251 or 10119. (Photogr. by Dr. Docters van Leeuwen; by courtesy of the "Foto arch. Kon. Inst. v/d Tropen").

next to this number is written '= 29280' in the handwriting of Clemens. On these sheets the locality also has been changed into that of *Clemens 29280*. The sheet of *Clemens 27415* in BM has not been changed and is certainly not identical with the sheet of *Clemens 29280* from the same institution, which is *f. dilatatum*.

4c. f. complicatum (Miq.) Wief., *comb. nov.* — *O. moluccanum f. complicatum* Miq., *Ann. Mus. Bot. Lugd. Bat.* 4 (1868) 290. — *O. vulgatum* var. *australasiaticum* Luerssen, *J. Mus. Godeffr.* 3 (1875) 246, t. 13, f. 66—72, t. 15, f. 107—108, t. 16, f. 125—127. — **Fig. 1a; photogr. 7.**

Plant 4—35 cm high; rhizome cylindrical or subglobose; common stalk 1—15 cm long; trophophyll attached at the lower half of the frond; 1—8 by 0.7—3.5 cm, ovate, obovate, deltoid, or lanceolate, apex acute or obtuse, often apiculate, base attenuate; texture fleshy; venation with rather many small areoles, and, especially in the marginal parts, with mostly many, free ending veinlets; fertile stalk 3—18 cm long; strobilus 0.4—8 cm long, nearly always gradually passing into its stalk, basal sporangia often not reaching maturity.

Distribution. Specimens examined from Ceylon, Assam, Khasya, Thailand, Japan, Bonin Is, Sumatra, Malay Peninsula, Java, Lesser Sunda Is (Bali, Timor), Borneo, Philippines (Luzon, Samar), Moluccas (Buru), New Guinea, and New Caledonia.

Subgenus OPHIODERMA

(Bl.) Clausen, *Mem. Torrey Bot. Cl.* 19 (1938) 114; Nishida, *J. Jap. Bot.* 27 (1952) 167. — *Ophioglossum* sect. *Ophioderma* Bl., *En. Pl. Jav.* 2 (1828) 259; Prantl, *Ber. Deut. Bot. Ges.* 1 (1883) 353; *Jahrb. K. Bot. Gart. Berl.* 3 (1884) 299. — *Ophioderma* (Bl.) Endl., *Gen. Pl.* 1 (1836) 66; Presl, *Suppl. Tent. Pterid.* (1845) 55, 56 [= *Abh. K. Böhm. Ges. Wiss.* 5 (1847) 315, 316]; Nakai, *Bot. Mag. Tokyo* 39 (1925) 192; *op. cit.* 40 (1926) 371—372; Nishida, *J. Jap. Bot.* 27 (1952) 274, 275; *Bull. Nat. Sc. Mus. Tokyo* 4 (1959) 334

Terrestrial or epiphytic; no clear-cut demarcation between common stalk and trophophyll; trophophyll, if present, gradually attenuate into the common stalk, which may be very short; trophophyll mostly distinctly adnate to the fertile stalk; venation consisting of primary veins only, 'midrib' only present in the lower part of the trophophyll and continued in the fertile stalk; walls of the epidermis cells of the lamina always straight; strobilus with a fertile apex; spores mostly more or less triangular in outline, with a smooth exospore wall (fig. 2a, c).

5. *Ophioglossum simplex* Ridley *ex Bower*, *Ann. Bot.* 18 (1904) 205, t. 15; Clausen, *Mem. Torrey Bot. Cl.* 19 (1938) 119—120. — *Ophioderma simplex* Nishida, *Bull. Nat. Sc. Mus. Tokyo* 4 (1959) 335.

Terrestrial, c. 8—15 cm high; rhizome subglobose, bearing 1—4 fronds simultaneously; trophophyll absent or only represented by a very small lateral outgrowth, which may be innervated; sometimes a small (c. 3 cm), flattened, green, all sterile frond present; strobiles c. 2 cm long.

Distribution. Endemic in Malesia: Malay Peninsula (no specimens seen), Central Sumatra, Sarawak, and Moluccas (Ceram).

6. *Ophioglossum intermedium* Hook. *f.*, *Ic. Pl.* 10 (1854) t. 995; Clausen, *Mem. Torrey Bot. Cl.* 19 (1938) 118—119. — *Ophioderma intermedium* Nishida, *Bull. Nat. Sc. Mus. Tokyo* 4 (1959) 335. — **Fig. 2 c.**

Terrestrial, 10–25 cm high; rhizome either subglobose, or horizontal and cylindrical, bearing 1–3 fronds simultaneously; common stalk 4–12 cm long; trophophyll erect, linear or lanceolate, never falcate, sometimes bifurcate towards the apex, 5–15 by 0.5–1.5 cm, apex acute; fertile part attached below the widest part of the trophophyll if the latter is not linear, clearly surpassing the trophophyll; fertile stalk 2–10 cm long; strobilus 1.5–7 cm long, mostly shorter than the stalk.



Fig. 2. a. *Ophioglossum pendulum* f. *nutans*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Brass 2902. — b. *O. gramineum* var. *majus*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Docters van Leeuwen 10119. — c. *O. intermedium*, $\times \frac{1}{2}$, venation $\times 1\frac{1}{2}$, Clemens 10243.

Distribution. Endemic in Malesia: Central Sumatra, West Java, North and West Borneo, and Philippines (Luzon, Mindoro).

7. *Ophioglossum pendulum* Linn., Sp. Pl. ed. 2 (1763) 1518; *incl. β fronde falcata* Grev. & Hook., Bot. Misc. 3, part 8 (1832) 219; *incl. f. angustatum* v. A. v. R., Mal. Frens Suppl. 1 (1917) 454; *incl. f. nutans* v. A. v. R., l.c.; Bull. Jard. Bot. Btzg, sér. II, 28 (1918) 36; *incl. ssp. falcatum* (Presl) Clausen, Mem. Torrey Bot. Cl. 19 (1938) 117—118; Amer. J. Bot. 41 (1954) 493. — *Ophioderma pendulum* Presl, Suppl. Tent. Pterid. (1845) 56 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 316]; Nakai, Bot. Mag. Tokyo 40 (1926) 372, *incl. var. falcatum* Presl, l.c.; *incl. f. ramosum* Nakai, l.c. 373. — *O. furcatum* J. Smith, Ferns, Brit. & For. (1866) 272, *nom. nud. non* Roxb. 1844. — *O. moultonii* Copel., J. Str. Br. R. As. Soc. 63 (1912) 72; v. A. v. R., Mal. Frens Suppl. 1 (1917) 454. — *Ophioderma falcatum* Degener, Fl. Haw., Fam. 1 (1932). — *O. falcatum* Fowler, Amer. Fern J. 30 (1940) 10; St. John, Occ. Pap. Bish. Mus. 15 (1940) 356; Skottsbo., Medd. Goteb. Bot. Trädg. 15 (1942) 36.

Epiphytic or terrestrial; rhizome creeping, 1—3 cm long, fleshy, bearing 1—6 fronds simultaneously; trophophyll up to 200(—400) by 0.6—9 cm, often one or more times furcate, apex acute or obtuse; fertile part single, rarely two collaterally, fertile stalk 0.5—10 cm long, always shorter than the mature strobilus which is 2—45 cm long.

Distribution. Old World tropics from Madagascar and the Seychelles eastward to Hawaii and the Marquesas Is, where the humidity is high enough throughout the year. A record from Quito on the mainland of South America is probably erroneous. *O. pendulum* reaches its northernmost stations on the islands of Tanegashima and Yakushima just South of the island of Kyushu and in the Bonin Arch., its southernmost stations in New South Wales on Ash Island and at the source of the Brisbane River.

Ecology. Almost always epiphytic in the shade of forests under everwet conditions; *f. falcatum* may also occur in more exposed places.

Notes. *O. pendulum* in its typical form has the largest range in Indo-Malaysia. Two other forms occur: *f. nutans* within this area, extending from Sumatra to the Solomons, and one outside it, *f. falcatum*, in Hawaii. Both forms have been described as species, but are here reduced to the rank of a *forma* because of the fact that, although I do not like to suppress them entirely, the intermediates connecting them with the type form are too numerous to maintain them as varieties. For instance, of *f. nutans* I have seen 15 typical specimens, but also 14 which are in some respect or other intermediate with *f. pendulum*. Of *f. falcatum* I have seen 6 typical specimens, all from Hawaii, but 5 intermediates with *f. pendulum*, partly from Hawaii, but also from Samoa, Fiji, Louisiades, and Luzon. There is even one intermediate between *f. falcatum* and *f. nutans*, in the Louisiades. In the identification list I have indicated these intermediates by means of mentioning two numbers of forms, e.g. 7a/b. Whether these forms have the character of races and the intermediates are hybrids or that this variation is caused largely by habitat conditions cannot be studied in the herbarium; one should for this purpose take many plants onto cultivation.

A similar condition is found under *O. reticulatum*.

For reasons mentioned in the introductory remarks I refrain from naming a dwarf form (denoted in the quoted numbers by "(d)", which is found in New Guinea and the neighbouring islands. This form seems to be related with both *f. pendulum* and *f. nutans*, but is not simply intermediate between them. For the same reasons I prefer to reject *forma angustatum* v. A. v. R. (denoted in the quoted numbers by "(a)").

I have seen several, otherwise normal specimens, with twin or forked fertile parts

(denoted in the quoted numbers by "(t)" and "(f)" respectively). Nakai, Bot. Mag. Tokyo 40 (1926) 327, described this as *f. ramosum*. These forms seem to be genotypical, at least in most cases, as they are both geographically centred in the Philippines. Obviously they are closely akin and modifications of the same genotype, as several collecting numbers contain specimens of both categories; furthermore, even in the rather few specimens examined, the situation of the bifurcation varies from near the base of the stalk to near the apex of the strobilus. I do not think these forms merit to be designated taxonomically.

Van Alderwerelt van Rosenburgh (1917, 454) said about his *O. pendulum f. nutans* that it had been collected in New Guinea and that it "has the fronds rather short, spreading, falcate (nutant)". From this description and from a sheet (Lörzing 7325), identified by him as belonging to this form, I conclude that it is synonymous with var. *moultonii*. Later Van Alderwerelt (1918) referred also Brooks 356/S to this taxon, but I consider this number as intermediate between *f. pendulum* and *f. nutans*.

St. John (1940, 355) explained that Smith based his *O. furcatum* on *O. pendulum* var. *furcatum* Presl (Suppl. Tent. Pterid. 1845, 56). However, neither on the cited page, nor anywhere else Presl published this name. Hence, *O. furcatum* J. Sm. must be considered a *nomen nudum*. It should not be confused with *O. furcatum* Roxb. [= *Lygodium circinnatum* (Burm.) Sw.].

In the collection of the Paris Herbarium I have found two sheets carrying the number "Beche 108". One of them is intermediate between *f. pendulum* and *f. falcatum*, the other one is *f. pendulum*. For this reason and because the labels attached to these sheets are not identical, I am in doubt whether these sheets really belong together.

KEY TO THE FORMS

1. Frond not or only slightly falcate, up to 200(—400) cm long, pendulous, flaccid . . . a. *f. pendulum*
1. Frond distinctly falcate, up to 60 cm long, often not pendulous, more rigid.
2. Trophophyll clearly stalked, apex acute, never forked, venation in dried specimens mostly clearly visible b. *f. nutans*
2. Trophophyll gradually narrowed towards the base, apex obtuse, often forked, venation even in dried specimens often hardly visible c. *f. falcatum*

7a. *f. pendulum*. — Synonymy see under the species, except *fronde falcata*, *f. nutans*, var. *falcatum*, ssp. *falcatum*, *O. furcatum*, *O. moultonii*, *O. falcatum*, *Ophioderma falcatum*, and *Ophioderma pendulum* var. *falcatum*.

Trophophyll up to 200(—400) by 0.6—9 cm, ribbon-shaped, pendulous, often undulate, texture fleshy in fresh specimens, but becoming rather thin in dried material; venation in fresh specimens inconspicuous, in dried material mostly clearly visible; $n = c. 480$.

Distribution. Coinciding with that of the species, in its typical form probably not in the Hawaiian Is. Specimens examined from Madagascar, Seychelles, Ceylon, Indochina, Thailand, Formosa, Japan, Sumatra (also Krakatao), Malay Peninsula, Java, Lesser Sunda Is (Bali, Timor), Borneo, Celebes, Talud, Philippines (Palawan, Luzon, Polillo, Mindoro, Negros, Samar, Mindanao), Moluccas (Ternate, Halmahera, Ceram, Ambon), Micronesia (Palau, Carolines, Marianas), New Guinea, also Louisiades, Key Is (Woodlark, Misima, Tagula), Admiralty Is, Solomons (Bougainville, S. Isabel), New Hebrides, Loyalty Is, New Caledonia, Fiji Is (Vitu Levu, Vanua Levu), Samoa Is (Opulu, Savaii), Tubuai Is (Rimatara).

Ecology. Forma *pendulum* often grows on the humus nests collected by large *Platyce-riums* or *Aspleniums*. When carrying large *Ophioglossums*, these plants often seem to be

slowly dying, not as a result of parasitism, but because the *Ophioglossum* competes too drastically for food and/or water (Holttum, Fl. Malaya, Ferns, 1954, 41).

7b. f. nutans v. A. v. R., Mal. Ferns Suppl. 1 (1917) 454. — *O. moultonii* Copel., J. Str. Br. R. As. Soc. 63 (1912) 72. — Fig. 2a.

Lamina clearly stalked, common stalk 4—30 cm long, at least in the upper part winged. Trophophyll simple, often distinctly falcate, 12—35 by 1.5—5.5 cm, tapering at both ends, apex acute; venation clearly visible, at least in dried specimens; fertile part attached on the lower half of the lamina, fertile stalk 0.5—3.5 cm long, strobilus 2—16.5 cm long.

Distribution. Specimens examined from Sumatra, North Borneo, West New Guinea, and the Solomon Is; in Mindoro a specimen was collected which is intermediate with *f. pendulum*; such intermediates were also found in Sumatra, Borneo, New Guinea, Louisiades, and New Hebrides.

Ecology. Humid mountain forests, approximately between 900 and 1700 m.

Note. Copeland (1912, 72), having seen only three sheets of *O. moultonii*, all from North Borneo, accepted it to be "an amply distinct, and apparently very constant species". I had the opportunity to examine more material, collected in a much wider area, and I found a much greater variability. I found about as many intermediate forms with *f. pendulum* as pure 'moultonii' and prefer to reduce *O. moultonii* Copel. to a form of *O. pendulum*.

7c. f. falcatum (Presl) Wief., *comb. nov.* — *O. pendulum* β *fronde falcata* Grev. & Hook., Bot. Misc. 3, part 8 (1832) 219. — *O. pendulum* var. *falcatum* Presl, Suppl. Tent. Pterid. (1845) 56 [= Abh. K. Böhm. Ges. Wiss. 5 (1847) 316]. — *Ophioderma falcatum* Degener, Fl. Haw., Fam. 1 (1932). — *O. pendulum* ssp. *falcatum* Clausen, Mem. Torrey Bot. Cl. 19 (1938) 117—118. — *O. falcatum* Fowler, Amer. Fern J. 30 (1940) 10.

Often erect, up to 50 cm high; trophophyll hardly stalked, 1—3(—5) cm wide, distinctly falcate, simple or furcate (but rarely more than once), apex blunt; texture rather leathery, venation even in dried specimens often inconspicuous; fertile part often attached at, or even above, the middle of the lamina, fertile stalk 0.5—2 cm long, strobilus 5—8 cm long.

Distribution. In its pure form only in the Hawaiian Is. Specimens which are intermediate with *f. pendulum* are found in Luzon, Louisiades, Fiji, Samoa, and Hawaii.

Ecology. Terrestrial or epiphytic, often in more exposed sites than the other formae.

Notes. Though Degener did not expressly say so, he obviously based his *Ophioderma falcatum* on *Ophioderma pendulum* var. *falcatum* Presl; though not citing this variety explicitly he indicated the page where it was published. Later (1961) he cited *Ophioderma falcatum* (Presl) Degener, thus clearly indicating the origin of the specific epithet.

Ninan (1958, 299) identified the material from Ceylon, for which he gave the chromosome number, as belonging to ssp. *falcatum* (= *f. falcatum*). As this variety is to my knowledge not found in Ceylon, I assume a confusion with *f. pendulum*.

DUBIOUS SPECIES

O. ramosii Coppel., Philip. J. Sc. 56 (1935) 97, t. 1, f. 1, 2. From the original description and plate I think the type collection (*Ramos BS14771*) which is the only one known, is a monstrosity (of *O. reticulatum*?). It is about 45 cm high, lacks a trophophyll, and has an abnormally developed strobilus.

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IDENTIFICATION LIST

Apart from the Malesian material a fair number of specimens have been included from continental Southeast Asia, the Pacific Islands, and Australia.

All specimens are quoted under collectors' names, not under series.

Several collections are mixed, mostly due to the fact that different varieties or forms are present under one collecting number. In such cases "p.p." (*pro parte*) is added and the same number is entered twice. See for example *Clemens 28320*.

Further there are a number of collections which are intermediates between two forms of a species, and cannot simply be assigned to one form. In these cases two letters are added. See for example *Binnemeijer 4243: 7a/b*.

After the numbers belonging to *O. pendulum* sometimes letters are added: (a), (d), (f), or (t), which refer to forma *angustatum* v. A. v. R. (rejected by me), a dwarf form, specimens with forked fertile parts, and specimens with twin fertile parts, respectively.

Curators of herbaria are invited to send specimens, not mentioned in this list, to the author for identification.

List of taxa

Ophioglossum

1. *costatum* R. Br.
2. *gramineum* Willd.
 - a. var. *gramineum*
 - b. var. *majus* (v. A. v. R.) Wief.
3. *nudicaule* L. f.
 - a. var. *macrorrhizum* (Kze) Clausen
4. *reticulatum* L.
 - a. f. *reticulatum*
 - b. f. *dilatatum* (Miq.) Wief
 - c. f. *complicatum* (Miq.) Wief.
5. *simplex* Ridl. ex Bower
6. *intermedium* Hook. f.
7. *pendulum* L.
 - a. f. *pendulum*
 - b. f. *nutans* v. A. v. R.
 - c. f. *falcatum* (Pr.) Wief.

List of collections

Adelbert 37: 3 - 133: 7a — Aet & Idjan 227: 7a - 531: 7a — Ajoeb 460: 7a/b — Alston 708: 3 - 12424: 3 - 12512: 4b — Anderson 9034: 6 — van den Assem 1: 7a.
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